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The Effectiveness of Grade Two Interactive Radio English Instruction in Ethiopia

Summative Evaluation by EMA/MOE and AED/BESO II

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Part One

Introduction

1.1. Background

Following its development in Nicaragua in 1974, Interactive Radio Instruction (IRI) has been used time and again in many countries. In Kenya, Thailand, the Dominican Republic, Lesotho, Bolivia, Ecuador, Swaziland, South Africa, etc. This technology proved simple and effective, and adaptable to major subjects in the curricula. By enabling students to acquire superior instruction and improving the capacity of teachers to impart knowledge, IRI has been solving the demand for improved quality in primary education.

Nekatibeb (2000) indicates that the Educational Media Agency (EMA) in collaboration with the Basic Education Overhaul Project (BESO) /USAID initiated Interactive Radio Instruction English Programs for Grade One in 1999 in Ethiopia. The main objective for initiating this program was to improve the quality of English language instruction by producing high quality educational Interactive Radio Instruction programs to primary schools. English language instruction is emphasized in Ethiopia, because it is the official international language in the country, and is the medium of instruction in post-secondary education. Success in English is critical to achievement in higher education and is a major asset for the world of work. Because of the importance of English in Ethiopia, children begin studying English in Grade One.

Radio made its entry to Ethiopian education in 1969. Until IRI was introduced, the emphasis was on broadcasting weekly supplemental English radio programs for primary grades. The interactive approach was different from the supplementary programs for many reasons. First, there were 4-5 programs instead of just one program per week. Second, the scripts were written in a way that actively engages the children. Every few seconds the children respond, usually by speaking, but sometimes by writing. Third, there were additional communicative language learning activities after the end of the program. The IRI lessons were based on the curriculum and for the pilot project, teachers were provided the lessons on audiocassettes.

Nekatibeb (2000) documented the following possible benefits to be gained from Grade 1 IRI programs in Ethiopia:

- Improved learning of English by Grade One boys and girls throughout the country,
- Greater skill and confidence in teaching English among primary school teachers,
- Laying a strong foundation for maintaining the standard of English language across all regions,
- Fully exploiting the educational potential of radio medium, and
- Increased integration between EMA and the Regional Education Bureaus in the areas of evaluation and support for teachers in schools.

Grade 1 IRI English radio program was introduced as a pilot project in 1999/2000. It involved the production and distribution of radio programs and teacher guides to carefully selected 24 schools in eight regions. Of this number, 16 were "experimental schools" where the impact of IRI was studied. The remaining 8 schools using IRI lessons were visited on regular basis in order for EMA to obtain formative feedback for the purpose of improving the lessons. There was also a control group of 16 schools that did not receive the IRI lessons and relied on the traditional English language instruction in Grade One. Results of both the formative and summative evaluation indicated that interactive radio instruction improved the quality of learning English in Grade One.

Following this preliminary experience, interactive radio instruction programs continued in Grade two in the same schools and students where IRI Grade one programs were introduced the pervious year. This report constitutes a summary data of the summative evaluation of the Interactive Radio English Program of Grade Two in Ethiopia. The aims and objectives of the programs are similar to those of Grade One, ie. to improve the quality of English language instruction in the Ethiopian primary schools. Summative evaluations were not required for Grade two IRI since the previous evaluation in Grade One has shown how the process needs to be guided and implemented to produce effective results.

1.2. Aims and Objectives of the Study

The overall aim of the study was to analyze the academic gains of Grade two students exposed to Interactive Radio English Instruction Programs relative to Grade two students who have not been exposed to the programs. As a secondary overall objective, it also reflects upon the impact of IRI programs on equity issues. The objectives of this study are:

- To compare the academic scores and gains of students exposed to IRI English Programs in Grade Two with gains of students of the same grade having no exposure to these programs.
- To describe the academic scores and gains of students with and without IRI programs in terms of school location, students' sex, students' age, status of grade two, class size and presence of the shift system.
- To indicate the implication of the results of findings of the study to policy and practice.

In general the current study is an attempt to examine the contribution of Interactive Radio Instruction Programs to improve quality and equity in Ethiopian education, particularly in English language, one year after the initiation of primary schooling by children.

1.3. Significance of the Study

There is a tremendous emphasis given to improve the quality of English instruction in Ethiopia. This is because the language is considered as a gateway to the world since it is the most widespread at present. Moreover, English is also a working language in many institutions in Ethiopia. It is a language of instruction and one of the subjects that determines whether or not a student achieves higher education. Providing quality learning in English is therefore, vital to enable students to remain in formal schooling as well as in the world of work. IRI is one of the experimental approaches to meet the improvement needs of quality in the instruction of primary English. The study which was conducted on Grade One English has created a baseline data as to the effectiveness of this experimental approach, and it provided vital information for decision makers with regard to the rationale for continuing the

program on a wider scale. The Grade Two study is a continuation of the first study which provides vital information on the effectiveness of IRI in Grade One, and how much achievements improved overtime by the same students.

Ethiopia is dedicated to meet the goal of Universal Primary Education (UPE) by 2015. In order for this to happen, it is not sufficient to expand access alone. Controlling repetitions and dropouts is required to optimize the flow of students through the system. One way of ensuring the steady flow of students in the education system relates to providing quality primary education. IRI has proved over the years, in many countries and different subjects that it could improve the quality of education. This study, therefore, provides an indication or feedback of what the improvement of students looks like, and by so doing indicates the progress being made towards meeting UPE.

Disparity is a basic problem encountered by Ethiopian education. The issue has several dimensions including gender, location, region, etc. Experiences from several countries suggest that IRI makes important impact in closing equity gaps in education. Since the Grade One study has already revealed the potentials of IRI in correcting some of the disparities, this study, as a continuation of the first, assists in monitoring whether or not the use of IRI has continued to reduce disparity over the next year.

Although Ethiopia has many years of experience in supporting primary education with radio, only a few researches have been conducted as to the effectiveness of the programs. Due to this, both the techniques of educational radio research and the areas of investigation had a very limited scope of development. From these perspectives, the current study enriches the possibilities for conducting research on radio programs and raises some important issues for future investigation.

1.4. Limitation of the Study

Although language skills can be assessed in a form of listening, speaking, reading and writing, this study is limited only to the assessment of listening comprehension. A variety of reasons including logistical, experimental and pedagogical have contributed to this

limitations. The assessment of other skills is essential because it is expected in the curriculum to cover the above skills.

The fact that IRI is new in Ethiopia has contributed to some problems in data collection. While reliance on South African experience has solved many design issues in test development, the information acquired on schools was limited only to some issues thus obtaining more information could have a vital importance to make more levels of analysis of data in the present study.

There has been a considerable attrition of participants from the study. Some of the reasons have to do with technical problems in post- test production on tape recorders while others are normal mortality effects. Had it been possible to stop this attrition, it could have strengthened the generalizability of findings in the current study.

The administration of the tests using a tape recorder distanced the testers from those who take the tests because their potentials to solve some problems in terms of instruction and make corrections were not possible. In fact, the use of the mother tongue for instructions in some places might have produced some misconceptions.

The use of pictures as test instruments might need some level of experience and maturity from children. Difficulties in interpreting or reading pictures might interfere with assessment of student listening skills.

2. Literature Review

2.1. Emergence of Interactive Radio Instruction

Learners retain approximately 10 percent of what they read, 26 percent of what they hear, 50 percent of what they see and hear, but 90 percent of what they say and do (Silcox, 1993). It is no wonder, then, that interactive radio instruction (IRI)—a methodology developed to turn a typically one-way technology into a tool for active learning inside and outside of the classroom continues to be an attractive educational strategy in developing countries.

The original model for teaching mathematics through IRI, created in Nicaragua by a team from Stanford University in the early 1970s, sought to combine the low cost and high reach of the radio medium and a clear understanding of how people learn. Since that time, eighteen countries around the world have developed IRI programs for a variety of subjects, audiences and learning environments. Many of these programs have been sustained for up to ten years and are continuing. The methodology has been expanded and adapted to include different levels of mathematics, science, health, English, Spanish, Portuguese, environmental education, early childhood development and adult basic education for learners of all ages. In each case, the series has been designed by local specialists specifically to capture the interest of the learner and to meet learning objectives in that country (See Appendix 1 for a list of IRI projects and their current status).

For countries with high hopes, but small educational budgets and difficulties in training teachers, providing educational materials, maintaining quality and increasing access to meet the educational needs of a broad populace of learners, selected strategies and technologies must be effective, reliable and meet the countries' needs. As this review will reveal, IRI can meet such criteria.

2.2. Interactive Radio Instruction as a Pedagogical Tool

IRI is the use of interactive lessons in which an audio component delivered by an "audio teacher" through a radio or audio cassette and classroom activities carried out by the learners are carefully integrated. Within this structure, the audio teacher carries the main weight of

the teaching, and directs learner activities (exercises, answers to questions, songs, and practical tasks) which take place during carefully timed pauses in the audio script, utilizing the classroom teacher as a facilitator. IRI is distinct from most other forms of distance education because its primary goal has been the improvement of educational quality. Unlike many distant learning efforts designed to address issues of access, IRI began as a classroom tool to counteract low levels of teacher training, poor achievement among learners and limited resources. While IRI has demonstrated that it can be used to expand access and increase equity in both formal and non-formal educational settings, it retains an emphasis on quality improvement through a development strategy and methodology that requires active learning, attention to pedagogy, and formative evaluation to be included in the design.

The IRI methodology is also different in that it requires learners to react to questions and exercises through verbal response to radio characters, group work, and physical and intellectual activities *while the program is on the air*. For both the teacher and students, the lesson becomes an immediate hands-on and experiential guide. Short pauses are provided throughout the lessons after questions and during exercises to ensure that students have the time to adequately think and respond. Interaction is also encouraged within the learning environment among the teacher and learners as they work together to conduct short experiments, undertake activities, and solve problems using local resources, imaginative situations and stories.

The pedagogy of IRI is more deliberate than active learning alone. IRI series guide participants in the learning process through a progression of activities related to measurable learning objectives. Educational content is organized and distributed across lessons so that learning is built upon previous knowledge and new learners more easily construct an understanding of the subject being taught. Activities and problems are first modeled by radio characters so that the teacher and learners have an idea of the process they are undertaking and the skills and support that may be required. All of these elements are knit together through story lines, music, characterization, and other attributes available through the audio medium. IRI programs are tailored specifically to the audience and the situation where they will be used. One of the most important aspects of the design, therefore, is the reliance on

audience research, participation, and field level formative evaluation to ensure that lessons are engaging and relevant, and that learners can achieve the educational objectives. In the preparation of an IRI series, the format, activities, and pauses in a program change with each cycle of feedback and observation.

There are certain trends worth noting in the evolution of IRI since the 1970s. For example, the original concept of making programs "teacher-proof" has been largely discarded. Instead, most new programs serve as a guide or tool for the teacher and, in some cases, are used for teacher training. The early childhood development series used in Bolivia, Nepal and South Africa, for example, has learning objectives for two audiences—the young learners *and* their teachers and caregivers. This arrangement has been particularly important when the radio characters point out elements of early childhood development as the teachers and caregivers interact with the young children during the IRI program. The series serves as both non-formal radio program for children and hands-on training tool for caregivers and kindergarten teachers. The same strategy has recently been adopted for English programs in the Dominican Republic and Costa Rica so that teacher training is an intrinsic part of the total system.

Strategies have also been devised to make IRI more entertaining and culturally-appropriate for a variety of subject areas. For example, a soap opera/novella style was adopted for the fifth grade environmental education programs in Costa Rica. As a result, story and drama have become popular ways to demonstrate interactions between teachers and learners, or to initiate more constructivist styles of learning in various segments of other IRI programs.

More attention is also given to making the programs engaging, relevant and appropriate for both boys and girls. A recent review of research data and script analysis of four IRI programs showed that while girls were making great strides in achievement, the programs did not take full advantage of the potential to present positive role models and interactions between female and male characters. A script analysis process was subsequently created for IRI script writers in order to enhance IRI programs in this regard (Hartenberger and Bosch, 1996).

Finally, the design of IRI has evolved in response to educational research and ideological changes in learning theory. For example, South Africa took a particular interest in developing constructivist programs, and attempted to make English and mathematics more open to individual discovery and analysis. Even countries with a long history in IRI—such as Bolivia—have shown increasing interest in updating their methods so that their programs are compatible with current interpretations of learning. The following figure summarizes the previous and current approaches to IRI.

Figure1. Characteristics of IRI in Its Previous and Current Forms

Characteristics of IRI	
Early Prototypes	**Current Trends**
• Regular pauses for learner interaction with radio • Directed to one audience: the student • Distributed learning throughout series • Use of known local resources, such as rocks and sticks • Use of characters and imagination to aid in learning • Broadcast over radio • ”Teacher proof” • Used repetition, reinforcement, and problem-solving • Incorporates pedagogical principles of how teaching/learning is constructed • Targeted to maths and language in school • Always uses supplementary worksheets for students and guides for teachers	• Regular pauses for learner interaction with radio • Requires interactions amongst learners and teachers/facilitators to facilitate an active learning environment; often directed to two audiences • Distributed learning throughout series • Use of known local resources, such as rocks and sticks • Increased use of characters who act as role models, gender, dramas and imaginary settings • Broadcast over radio, used on cassette, or both • Teacher training deliberately incorporated • Incorporates more constructivist approaches • Incorporates pedagogical principles in how teaching/learning is constructed • Used for a variety of subjects and learning environments • Sometimes uses supplementary materials, depending on ability to disseminate cheaply

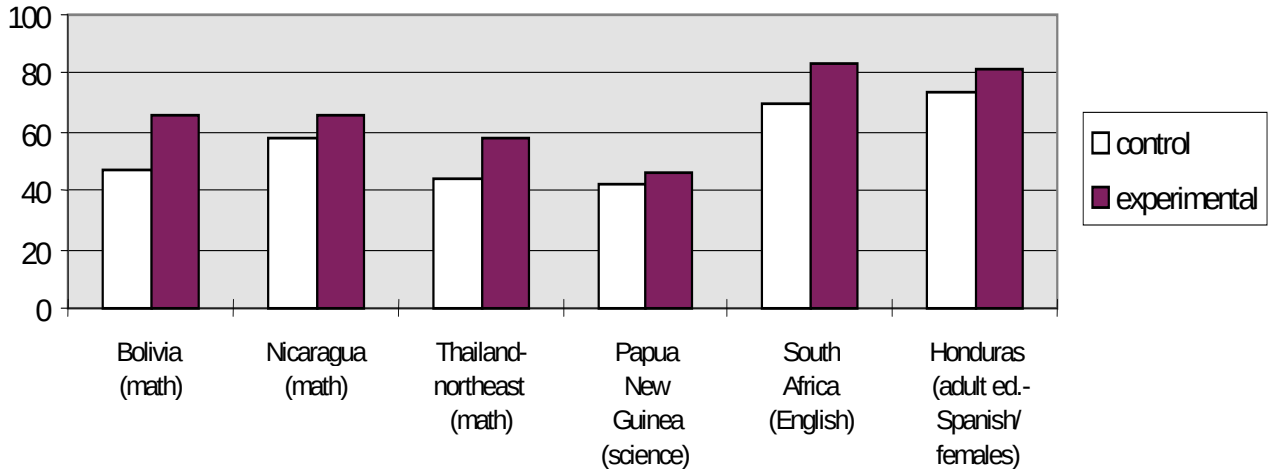
The above table indicates that IRI applications differ in the degree of activity required of the learners, the subject matter, the age and background of the learners, the learning environment, and background of the teacher or facilitator. One might even say that the differences are greater than the similarities. But despite these differences, and the adjustments that IRI has undergone over time to become more culturally intriguing or

educationally up-to-date, and the methodology of IRI has worked well enough that it is still used in projects around the world.

2.3. Effectiveness of IRI

The attraction of the IRI approach can be at least partially attributed to the insights from well-evaluated projects that have repeatedly demonstrated learning gains for students using IRI programs (as compared to students in control groups; See Figure 2). While these data are

Figure 2: Comparisons of Mean Post-test Scores



impressive at face value, they are more impressive when effect sizes are analyzed (taken as the effectiveness quotient in cost-effectiveness studies). In most cases, students show progressively greater increases in achievement over time. In South Africa, for example, students who received less than 33 English in Action lessons improved by 6.7 percent, students who received between 34 and 66 lessons improved by 13 percent, and students who received more than 66 programs improved by 24 percent (Leigh, 1995). Similar results were found in Bolivia. In 1991 evaluators found out that students scored even higher (61.6 percent) (Tilson et al 1991) wrote that the average score in Maths of second graders using Radio jumped from 47 percent to more than 66 percent (the mean score of the control group was 35 percent). Of these, the experimental students who had already completed one year of

the radio lessons did much better (51.9 percent correct), and those students who completed two years of radio programs.

2.4. IRI and the Expansion of Access

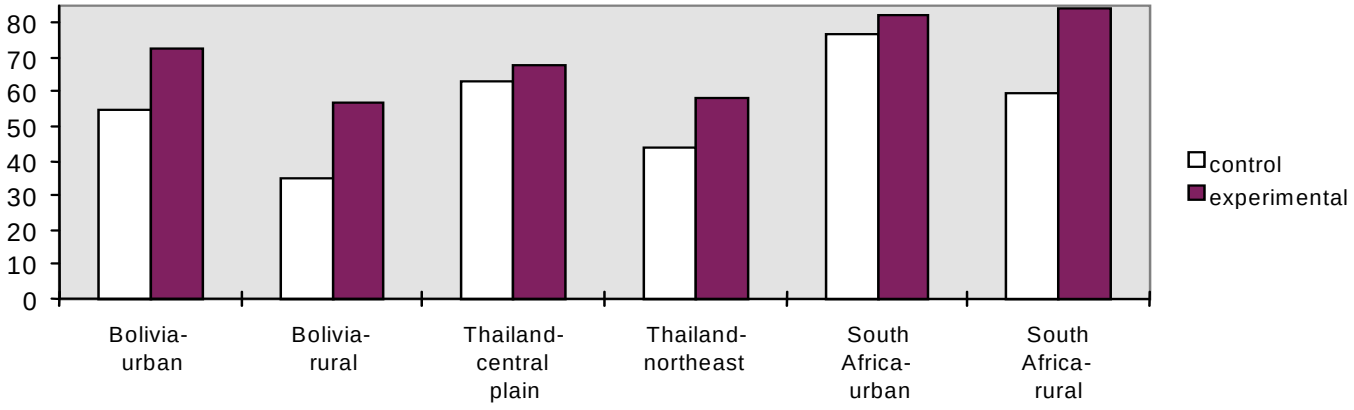
Leading evaluators assume that it is the basic tenets of active learning and the IRI methodology that make the difference. IRI seems also to ameliorate other obstacles to education. Substantial learning gains have been demonstrated in IRI projects that were used in non-formal settings, or were used in unusual ways to overcome a particular educational barrier such as poorly-trained teachers, lack of schools, or incompatible school scheduling. In the Dominican Republic, for example, an IRI project called RADECO was created for children who had no schools. The program has now been broadcasting for twelve years. In early evaluations, it was discovered that the skills of children who had just five hours of integrated instruction a week using IRI and thirty minutes of follow-up activities were comparable to those of students who were in a regular formal schools for more than twice the amount of time. Studies showed that first graders using the RADECO programs responded correctly 51 percent of the time on post tests, versus 24 percent of the time for the control group. Second graders using IRI gave 10 percent more correct answers. Overall, even though these students had enormous obstacles, students who used IRI for an hour a day had comparable results in reading, writing and language for both grades, when compared to the control group. They also performed significantly better in mathematics (reported in Goldstein and de Jesus, 1995). Based on the early successes of the RADECO project, IRI programs are currently being developed in other countries facing different types of educational obstacles, such as the failing schools of Haiti, non-formal early childhood development centers in Bolivia and Nepal, and adult learning centers in Honduras.

2.5. IRI Helps to Close Equity Gaps

2.5.1. Urban/Rural Equity Gaps:

Evaluations of IRI programs indicate that they can make a substantial impact on educational equity. Figure 2 displays results of evaluations conducted in Bolivia, Thailand and South Africa, which show much higher total gains than their urban counterparts who have greater access to materials and better trained teachers. This distribution of evaluation results follows a pattern that has been demonstrated in other countries and indicates that the IRI programs are not only increasing quality, as reflected in gains in achievement, but are also making an impact upon urban/rural equity gaps.

Figure 3: Urban/Rural Differentials

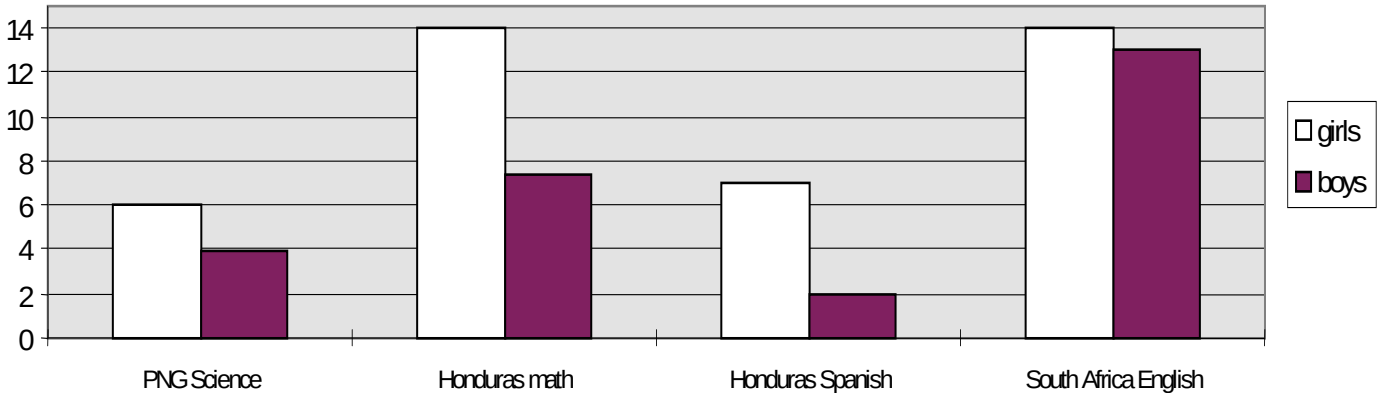


2.5.2. Gender Gaps:

In a recent retrospective analysis of the potential of IRI to help close gender equity gaps, a similar trend was discovered (Hartenberger and Bosch, 1996). While girls were achieving about the same as boys in the post-tests, because their baseline scores were lower, the total achievement for girls in the experimental groups was greater. This finding was demonstrated in science in upper primary school in Papua New Guinea, English in lower primary in South Africa and adult basic education in Honduras, suggesting that the age of the learner and the subject taught were not controlling variables.

Another study of learning gains conducted in Honduras shows that the combination of IRI and other interventions may have synergistic effects. The study found that when IRI programs are introduced with new textbooks, the impact upon learning gains almost doubles the impact of just providing textbooks (with an effect size of 0.61). The indications are that a well-constructed multichannel approach—where different educational strategies are deliberately aligned so that traditional and nontraditional approaches reinforce each other may have the greatest impact upon learning (Godoy-Kain, 1990).

Figure 4: Total Achievement in Mean Post-tests by Sex



2.6. Finance of IRI Projects

Alongside the data on learning gains is a growing body of literature analyzing the economics of IRI. A brief description of how IRI projects are generally designed and implemented reveals the implications of these studies. IRI projects are front-loaded—that is, they have higher initial fixed costs associated with creating management and training systems, and producing audio and print programs, when compared to conventional systems. At the same time, they have far lower recurrent costs associated with permanent staff, dissemination, training and maintenance. While IRI projects have capacity-building components, they are also product-oriented and are evaluated continuously during the early design and production stages to ensure relevance and effectiveness (Figure 1). Because most of the radio programs

have gone through this extensive formative evaluation and have built-in strategies of training, active learning and quality control, high level use can be maintained relatively easily over time and the dilution of quality associated with some other strategies, such as pyramid training schemes, can be avoided. Teacher training and other recurrent costs stay relatively consistent over time after the development stage and only vary depending on how much training is integrated into the program, subject being taught, and the special circumstances of the country. Other recurrent costs include airtime, distribution of simple supplementary print materials such as one page worksheets inserted into local newspapers or distributed at the beginning of the year, batteries and radios, and the maintenance of a management system or unit focused on IRI.

IRI is also different from many other educational strategies because of the wide reach of the radio broadcasts. *As a result, increasing the number of learners increases the cost very little*. In contrast, most other interventions with high variable costs will require a proportional number of new school facilities, textbooks or teachers as additional learners are added. In an IRI project, these extra factors do not dramatically influence the cost of the program. Because the primary product—radio programs—is broadcast, the cost per learner decreases proportionally with an increase in users.

Most cost analyses of IRI programs project decreasing student costs over time using the underlying principle that the cost of development will be offset as more and more learners use the programs (Jamison, 1990; Tilson, et al, 1991; and Cobbes, 1995). In a study of Honduras mathematics programs conducted in 1990, for example, it was discovered that the annual cost-per-student of using IRI mathematics was US$2.94 in the first year when development costs were included (based on 200,000 students and including a discount rate of 7.5 percent). However, the incremental cost to continue the program fell to US $1.01 per student for each year thereafter, a cost that would be distributed across learners and Government. Moreover, this cost would be reduced dramatically if airtime, the highest cost item, was provided or if the number of learners was increased.

A similar 1991 study of Bolivia Math found that the cost-per-student would be US $1.51 in the first year including program development costs and a projected reach of 200,000 students, or US $1.04 if the number of students increased to 600,000. The incremental cost of sustaining the programs for 200,000 students per year, however, was only US $0.81 per student after the development stage (Jamison, 1990, Tilson, et al.1991). When compared to the traditional mathematics classes, the cost-effectiveness ratio of IRI programs would be 64 percent higher, assuming 200,000 students per year were reached (Jamison, 1990).

Early criticisms of this analysis suggested that the projected number of learners was too high, and that Bolivia would not be able to provide and sustain the use of IRI programs for very long. In 1996, after nine years of broadcasting, over a million learners had used the Bolivia Math and Health programs as part of the ministry's national curricula, a long-term total that even ambitious project evaluators did not anticipate. Records show that 184,490 students and teachers officially used the mathematics programs in 1996, and that if the shadow audience were included, (the incidental listeners, or formal or non-formal learners who discovered the series over the airwaves and used it on their own), total learner figures would be even higher. As the cost of airtime had also been distributed among a variety of radio stations around the country, it is likely that the overall cost-per-student in 1996 was even lower than previously projected.

A 1991 study conducted in Lesotho attempted to understand how the same type of program would compare in a country with completely different circumstances. Using the same methodology, an annual per-student-cost of US $0.94 was derived, of which only US $0.24 would be covered by the Government. While the per-student-cost is much lower than Bolivia's, it actually constitutes a greater percentage of Lesotho's total education budget than in Bolivia and, therefore, indicates a significant education policy decision. Compared to other options, the IRI programs in Lesotho are considered to be cost-effective, and are still being used today.

2.7. Cost-effectiveness of IRI

A number of cost-effectiveness studies have also found IRI to be a highly competitive educational strategy, when compared to other interventions. As early as 1988, Lockheed and Hanushek published a study that compared cost-effectiveness data on three IRI, two textbook, and four teacher training projects. Cost-effectiveness was measured as a ratio of incremental effectiveness (units of effect size) to incremental cost (dollars per student per year) and referred to as the *efficiency ratio*. The study shows that providing textbooks results in an attractive efficiency ratio of about 0.2 effect units per one dollar per year (with the exception of one case in the Philippines where the gain was 1.5 per dollar). All other interventions were considered less cost-effective than textbooks, with the exception of IRI, which proved to be more cost-effective with efficiency ratios in the 0.3 to 1.3 range.

Finally, in recent cost analyses conducted in South Africa, evidence suggests that IRI continues to be cheaper and more effective than alternative programs. The 1995 study shows that when the cost of South Africa's English in Action is compared with other English language programs, the cost-per-student of English in Action ranged from one-third to one-half of that for the other options (Cobbes, 1995). Like other projects, South Africa's English in Action is now broadcast country-wide, indicating that the recurrent costs associated with sustaining the programs are considered justifiable.

2.8. Interactive Radio Instruction in Ethiopia

The emergence of Grade One English IRI in Ethiopian has been presented in the first chapter. In this section the emphasis will be on the formative and summative evaluation results that were carried out during the project. Nekatibeb (2001) reported that the focus of the formative evaluation was to assess the micro-implementation of Interactive Radio Instruction Programs. This evaluation was carried out in 8 formative schools in eight regions from January-June 2001. Data were collected from multiple sources using multiple instruments including teacher's daily formative school observation questionnaires, zone media supervisor reports by telephone, external evaluator observation reports, focus group and workshop discussions, and written reports by Zone Media Supervisors. In the summative evaluation the

major goal was to assess the extent to which IRI programs were academically effective as compared to non-IRI programs. An experimental research method was adopted for the study using an English Listening Comprehension Test as an instrument for data collection.

Major findings from the formative evaluation indicate five main trends. First, there was a clear indication from teachers' classroom observation formats that the rate of utilization of IRI programs in the classrooms was high. EMA produced and distributed 124 programs for utilization by teachers in each classroom. This means that a total of 992 uses were expected from all schools while the achieved level of use was a 79% or 787 programs. In 5 of the 8 regions studied, the rate of utilization ranged between 83% and 98%. In the remaining 3 regions the rate of utilization ranged between 42% and 79%. In these 3 regions reasons for low use have been found to have relations with the wastage of instructional time due to the closure of schools by special government decisions and national examinations.

Secondly, IRI programs were accepted among users as opinions towards the general characteristics of IRI programs were found to be positive. Majority of external and teacher evaluations indicated that the clarity of lesson objectives, appropriateness of contents, relevance of the programs to children's life, the voice of radio, clarity of language in scripts, and the appropriateness of programs to student ability are of a high standard. Written reports and oral testimonies show the same trends (see Leigh 1995 and Nekatibeb, 2001). Thirdly, IRI enjoyed strong school administrative support. It has been discovered that IRI programs enjoy strong support from school principals. A quotation from school principal in Southern Region of Ethiopia says it all as follows in the report:

…The program is designed to improve the falling standard of the English language and I think it's a timely answer to this burning issue. It helps students to improve their language skills. The program goes with their age and mental development. It's also a good way of practicing the student- centred approach…

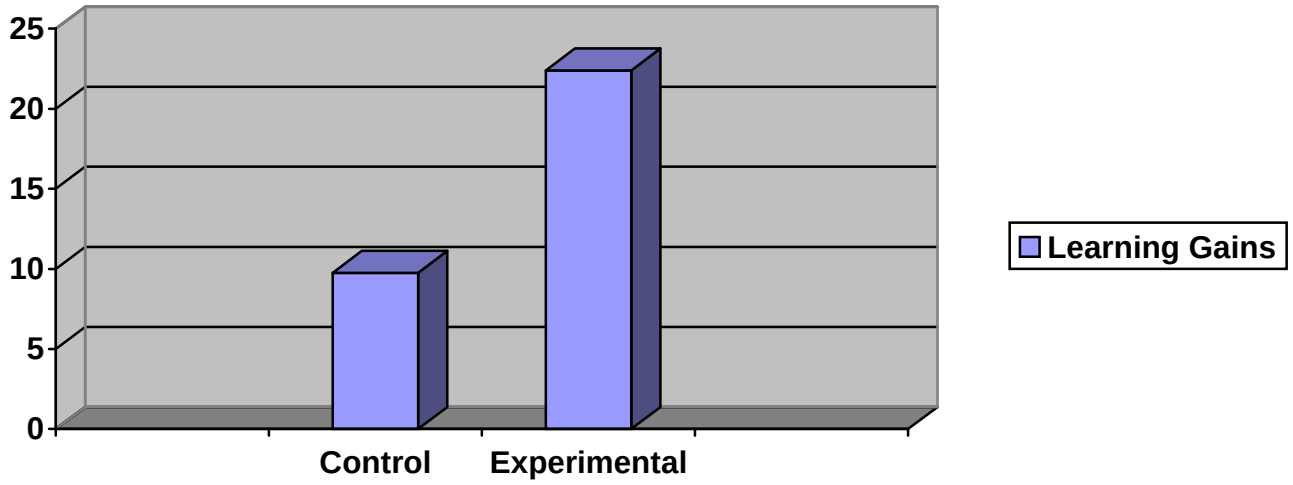
Fourth, students, parents, teachers and community representatives ascertained that IRI Programs improve student's cognitive development. An interesting statement by one of the parents, for example, says the following:

I have a son in Grade One and his elders in other grades. When I compared him with his elders, I discovered that he knows more names of animals, materials, sound of animals, and things in the environment in English than his elders. He also has good handwriting and makes no spelling errors. I did not know that he is in this special class, but now I realize the reason.

There were several such statements, which indicated agreements among users that IRI Grade One-English Radio Programs were useful for students' academic gain and behavioral change. Finally, teachers also strongly indicated that Interactive English Radio Instruction is extremely useful for their own professional development. Most expressed the view that IRI requires more reading and adopting new styles of teaching unlike the conventional teaching. They mentioned that IRI classes demand special preparation. From these perspectives, teachers think that IRI has a positive impact on teachers' knowledge and practices. Some even expressed that IRI is teaching them as well as their students. They told how their conversation, vocabulary, communications, knowledge of songs immensely improved. IRI teachers also noted that the impact of IRI are in using teaching materials, in helping students to participate in lessons, in trying to systematically conclude the lessons and in basing lessons on didactical rules. Teachers told that IRI helped them to adopt lessons to students' ability, encourage students for learning, to skillfully plan lessons, correctly pronounce words and to make classrooms more participatory or student-centered than teacher centered.

Findings from the summative evaluation also indicated that there is a huge potential for IRI to improve students learning in Ethiopia. Nekatibeb (2001) reported that students who used IRI programs gained 22% as compared to 9% in control schools as they did not use these programs. This implies that IRI is more effective than traditional instruction in improving educational quality. The following graph has been used to show learning gains in control and experimental schools.

Figure 5. Learning Gains in Control and Experimental Schools in Grade One English



In fact, this study has shown other important trends, which may have useful implications for policy making**.** Some of them include the following:

- IRI programs increased learning gains equally in urban and rural schools.
- Female students academically gained more than male students from IRI.
- IRI reduced gaps in academic performance between different age groups
- IRI reduced the gaps in academic performance that may persist between self-contained and linear approaches.
- IRI eliminated differences in learning gains due to differences in teachers' experience.
- Overall learning gains were higher in IRI than non-IRI conventional instruction in all regions.

Part 3

Research Methodology

3.1. Design

This study was a basic pre test-teach-post test design, which aimed at indicating how much the Interactive Radio English Programs in Grade Two contribute to changes in student learning as compared to non - IR instruction. The dependent variable, student achievement score was measured at two occasions: pre-test and post test. At pre-test both control and experimental students were given an English listening comprehension test which has been developed and recorded on a tape-recorder. This test was developed on the basis of Grade Two English curriculum. After an interval of seven months, the same tests were again given to the same students in their respective groups. The two principal independent variables were traditional instruction and interactive radio instruction. Traditional instruction was a normal routine in the control schools and there was no exposure of students to IRI in these schools. In experimental schools, students learned with IRI and the time allotted to English has been fully covered by IRI. This constituted 5 periods every week. One of the lessons at the end of each week constituted a 'review lesson". The main purpose of the review lesson was to provide summary lessons conducted in the week.

In order to ensure that the use of IRI creates a difference with control groups, teacher training, supply of textbooks, teachers' guides, radio and radio cassettes, and test materials were provided for the experimental groups. Control schools enjoyed similar conditions with experimental schools except for interactive radio instruction. Thus, they were occasionally visited, and provided with textbooks and test materials. Tests were designed to last only 2 hours so that students may not be bored or tired. In order to eliminate the effects of the pre-tests an interval of seven months were integrated to the design. The study included only Grade Two students who were assigned on random basis and there were no non-equivalent groups. Students who took pre-tests but did not appear for the post-tests were eliminated from analysis. Academic gain was the only dependent variable used operationally to measure students' learning and there were no other alterations.

For the purpose of examining what radio contributes to closing equity gaps, other descriptors (independent variables) were built into the design. Dane (1990) argues that such variables differentiate participants, but cannot be manipulated and are not subject to random assignment. Seen from these perspectives, the additional variables in the study represent participant characteristics as well as the characteristics of their working conditions that can not be manipulated.

3.2. Selection of Samples

Participants in this study constitute control and experimental groups who were exposed to the program in previous year in Grade One and they were randomly assigned to their respective groups. The number of regions included in the study was 8 and the number of schools was 16 control and 16 experimental schools. Each region had 2 schools from each gourp. The previous distribution of schools into their respective locations (urban and rural) was also retained.

As it is to be recalled from the previous study, all selected schools were government owned. In that study, it was explained that region was used as a stratifying criteria because of the variations in the delivery of primary education among regions. Therefore, it was decided to include as much number of regions as possible. School location (urban/rural) was considered to reflect the settlement pattern of the student population. In order to isolate or separate the impact of IRI as compared to the standard traditional approach, schools were classified into types (experimental and control).

Table 1. Participants by Region

Region	Number of participants in Group		Total
	Control	Experimental	
Tigray	98	118	216
Amhara	74	93	167
Oromia	82	94	176
SNNPR	116	122	238
Harari	36	90	126
Dire Dawa	77	83	160
Gambella	38	66	104
Addis Ababa	88	101	189
Total	609	767	1, 376

The above table indicates that the total number of participants in the control group was 609 and that in the experimental group was 767. In the previous study of Grade One, the total number of students who participated was 1081 in control group and 1039 in experimental group. The total number of students was 2,120. During the post test it went down to 679 for the control group and 787 in the experimental group and the total sample size was 1, 466. In this study it was interesting to see that the number of students in pre and post-test was not only consistent, but much lower than the previous study. This development can be related to the high dropout rates consistent with the primary education in general, and the high dropout rates in Grade One in particular.

3.3. Instruments of Data Collection

An English comprehension test for Grade 2 students was prepared by experts from EMA and ICDR as well as an international consultant. The test comprised items which measured reading, writing, speaking and listening skills based on the curriculum. The inclusion of different types of tests was to overcome the previous limitation which focused only on listening comprehension.

The tests were meant to be administered both at pre-test and post-test levels for experimental and control groups. A pilot study which helped in the item analysis of each type of test was conducted. Based upon the previous experiences and the current results, changes and improvements were made to the items. In order to control other variables that may influence

the experiment other than the independent variables, the tests were recorded and administered using a tape recorder.

Tests were administered by zonal media coordinators that had experience in administering Grade One IRI achievement tests. These were given an orientation about the special characteristics of Grade Two English instruments and how they may need to be conducted. In addition to the test instrument, a questionnaire was completed by zonal media supervisors and school directors. The information required from respondents focus on teacher and student characteristics, characteristics of schools and classes. Such information was collected in order to build descriptors in relation to which achievement data were analyzed.

3.4. Data Management and Analysis

Since tests were administered at different times, separate data files were prepared for the pre-test and the post-test. After coding the items was completed both data sets were entered into the SPSS program. For the purpose of comparison, these data were later merged to the same file. Questionnaires that provided different background information on participants and their schools were also entered to this program after the two files were merged. Data files were thoroughly cleaned to make sure that the analyses of data are conducted as planned.

The SPSS program provided an adequate capacity for analyzing both achievement results and questionnaires. The analysis of mean scores was used as the main instrument for summarizing data. T-tests and ANOVA were used for testing the null-hypothesis. Tables, and graphs/figures were used to demonstrate results and provide a comparative analysis of data.

Part 4

Findings and Analysis of Data

4.1. Student Achievement in Control Schools

Students who were exposed to traditional methods of instruction and participated in Grade Two English were totally 609. As Table 2 below indicates their pre-tests mean score was 41.11 percent. After a period of learning English for one year without IRI, the results of these students have risen to 50.43 percent. The overall academic gain was 9.31 percent. This result is statically significant as it can be observed in the table below.

Table 2 Student Academic Gains in Control Schools

School Status	Types of Test	N	Mean Scores	Std. Dev	Correlation R	Sig. (2-tailed)
Control	Pre-test	609	41.11	12. 33	0.568	0.000
	Post-test	609	50.43	15.83		
Mean Difference			9.31	13.44		

The correlation analysis also shows a strong positive relation between pre-test and post-test scores. This implies that the longer (time) students learn in the traditional methods the better is their learning and academic gains. Such finding is not surprising since having the opportunity to learn is always better than not to learn. The standard deviation indicates that the variation of students in terms of achievement is more similar at the beginning of the year than at the end of it. The implication is that variations in student learning gains are more pronounced as the result of traditional instruction rather than the common expectation that traditional schooling equally benefits all students.

4.2. Students' Achievement in Experimental Schools

The total number of sample students in the experimental schools was 767. The pre-test mean score of these students was 41.85 percent whereas their post-test achievement mean score grew to 55.85 percent. This makes the total academic gain of experimental schools 14 percent.

Table 3. Students' Academic Gains in Experimental Schools

School Status	Types of Test	N	Mean Scores	Std. Dev	Correlation R	Sig. (2-tailed)
Experimental	Pre-test	767	41.85	12. 85	0.606	0.000
	Post-test	767	55.85	15.87		
Mean difference			14.00	13.04		

It is interesting to observe that the pre-test and post-test results positively correlate with each other. However, the correlation value is indeed stronger than the correlation coefficient observed for traditional instruction to imply that more exposure of students to IRI produces more results than the exposure of students to traditional instruction. Although the variability of students achievement shows similar trends with control schools, there is no doubt that the variation of students learning gains from the mean is less in experimental schools. This implies that IRI programs enable students to close the gaps in learning gains as opposed to traditional instruction.

4.3. Comparison of Students' Achievement in Control and Experimental Schools

Students academically benefit from the two modes of instruction in Grade 2 English in Ethiopia. As the table below demonstrates, the academic gain of control schools is 9.31 percent and that of experimental schools is 14 percent. This gain is significantly different when results at pre-test and post-test are compared.

Table 4. Comparison of Students' Achievement Gains in Control and Experimental Schools

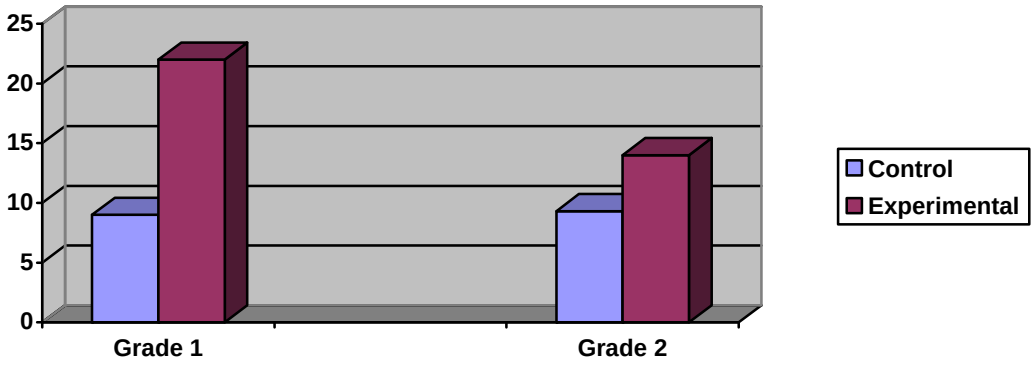
School status	Mean Gains	N	Std.dev	Sig. (2 tailed
Control	9.31	609	13.44	0.000
Experimental	14.00	767	13.04	
Total Gains	4.68*			

*Std.Error= 0.7178

However, the above findings also indicate that learning with IRI produces more student gains than traditional instruction by 4.68 percent. This finding is consistent with other findings pointed out in the review of the literature. The role of IRI is to enhance or improve student learning in comparison to traditional instruction. It is also interesting to see how the

variability in student achievement is stabilizing in experimental schools. The overall dispersion of students' gains is less for experimental (IRI) schools than for traditional schools.

Figure 6. Comparison of students' total academic gains in Grade 1 and 2 IRI programs



The above figure indicates that students' academic gains were higher in Grade 1 experimental schools than in Grade 2 experimental schools. In control schools it is interesting to see that differences between pre-test results and post-test results remained almost the same for both grades. The decrease in students' academic gains in experimental schools can be explained in different ways. One can be the increasing level of difficulty of the curriculum that may allow less achievement of students. Another can be the decreasing heat of the project as compared to the first year efforts. Still another can be the experience of the students with IRI for the second year which may produce less excitement in comparison to the first encounter.

4.4. Students' Academic Gains by Language Skills

In order to explore how interactive radio instruction programs fare with specific language skills development, three types of tests (listening, reading, writing) were administered. The following table shows the summary of results for each of the instruments utilized.

Table 5. Students' Mean Achievement Score Gains by Language Skills

	Status	N	Listening	Reading	Writing	Total Mean	SD	Sig.
Pretest	Control	609	50.8	46.3	16.1	41.1	12.92	.411
	Experimental	767	52.7	46.4	15.4	41.9	13.42	
Posttest	Control	609	58.8	58.3	24.3	50.4	16.43	.000
	Experimental	767	64.5	62.3	31.2	55.9	16.50	
Total Gains	Control	609	8.0	12.0	8.2	9.3		
	Experimental	767	11.8	15.9	15.8	14		

A comparison of pre-test results in the table indicates that the mean achievement scores in the three skill areas are similar. This result is natural since the results were obtained before intervention. However, it should be noted that students scored highest in listening comprehension followed by reading and writing.

The post-test results indicate that student achievement has risen in all three tests in both control and experimental schools. However, in all three cases students' academic gains were higher in experimental schools. This shows that when traditional instruction and IRI were compared in the development of language skills, IRI has shown superior results. At the same time, it has to be noted that students' achievement results in writing has still remained low. Irrespective of this, however, the highest academic gain in language skills development was witnessed in writing skills.

4.5. Students' Academic Gains in Control Schools by Sex

The Second National Learning Assessment in Ethiopia shows that males performed better than females in traditional primary education. Given this background, it is interesting to see how IRI impact affected student learning in Grade 2 in comparison with traditional instruction.

Table 6. Student Academic Gains in Control Schools by Sex

Type of Measurement	Sex of Students	Number of Participants	Mean Scores	Std.Dev.	Sig. (2 tailed)
Pre-test	Female	258	40.85	11.54	
	Male	350	41.22	12.82	
Post-test	Female	258	50.39	15.34	
	Male	350	50.37	16.14	
Academic Gains	Female	258	9.53	13.19	0.728
	Male	350	9.15	13.66	

The above table shows that the mean academic gains for female and male students was 9.53 percent and 9.15 percent respectively in control schools. The differences between the two means (i.e. 0.38 percent) was not statistically significant when t-tested for the equality of mean values (t=.348, df=606, sig.=.728). For both sexes the correlation analysis shows a strong positive (r=.550 for females, and r=.567 for males) and statistically significant (sig. 2-tailed 0.000) relationship between pre-tests and post-test results. This means that if background knowledge of students in English is high then the results in working with traditional instruction will increase. In relation to the national trend where males achieved more than females, the current finding of equal performance between both sexes is something that requires more investigation as to the reasons and if the result is consistent.

4.6. Students' Academic Gains in Experimental Schools by Sex

The mean achievement scores for female students increased by 13.48 percent from the pre-test to the post-test. For male students this gain was 14.48 percent. Such an increase by itself was a high achievement for interactive radio instruction. For both sexes the correlation analysis shows positive (r=.633 for males, and r=.571 for females) and statistically significant relations (Sig.=0.000) between pre-test and post-test results. This implies how working with interactive radio instruction increases student results.

Table 7. Students' Academic Gains in Experimental Schools by Sex

Type of Measurement	Sex of Students	Number of Participants	Mean Scores	Std.Dev.	Sig. (2 tailed)
Pre-test	Female	368	41.59	12.57	
	Male	399	42.09	13.12	
Post-test	Female	368	55.08	14.80	
	Male	399	56.57	16.79	
Academic Gains	Female	368	13.48	12.83	0.293
	Male	399	14.48	13.23	

Another key finding from the above table is the fact that both sexes gained equally from interactive radio instruction. The mean gain difference of 0.99 percent between male and female students in experimental schools was not statistically significant (t-value=1.053, df =765, Sig.= 0.293). This finding is also consistent with findings from other countries since interactive radio instruction has proved to minimize gaps in the academic achievement between the two sexes.

4.7. Comparison of Academic Gains of Students in Control and Experimental Schools by Sex

The table below shows that the mean difference of 0.9 percent between males in experimental and control groups was statistically insignificant. In other words both groups had similar standards. This trend is also similar for female students where a mean difference of 0.7 percent at the pre-test has shown no statistically significant difference when the means were t-tested. However, both groups have shown immense improvements during the post-test.

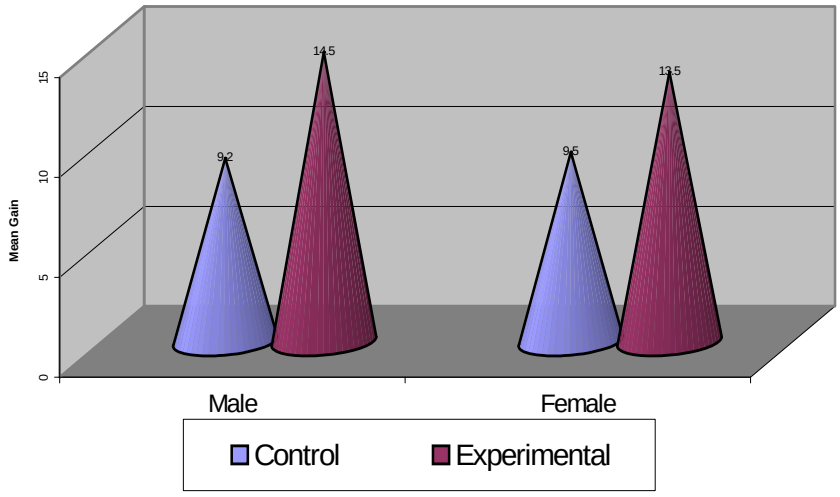
Table 8. Mean Score Differences of Experimental and Control School Students by Gender

Sex	Status	Pre-test				Post-test			
Male		Mean	N	SD	Sig.	Mean	N	SD	Sig.
	Control	41.2	350	12.8273	.361	50.4	350	16.1476	.000
	Experimental	42.1	399	13.1287		56.6	399	16.7912	
	Mean Diff.	0.9				6.2			
Female	Control	40.9	258	11.5483	.456	50.4	258	15.3488	.000
	Experimental	41.6	368	12.5706		55.1	368	14.8026	
	Mean Diff.	0.7				4.70			

For male students the mean difference between control and experimental groups was 6.2 percent while for females it was 4.70 percent in favor of the experimental school students. As the table above shows these mean differences are statistically significant for both female and male students signifying the fact that there were improvements.

Examining the learning gains of students by sex, one can also see that both male students and female students in control and experimental schools have gained more results in the post-test than in the pre-tests. However, these gains were more for experimental schools as the following figure demonstrates.

Figure 7 Learning Gains by Sex



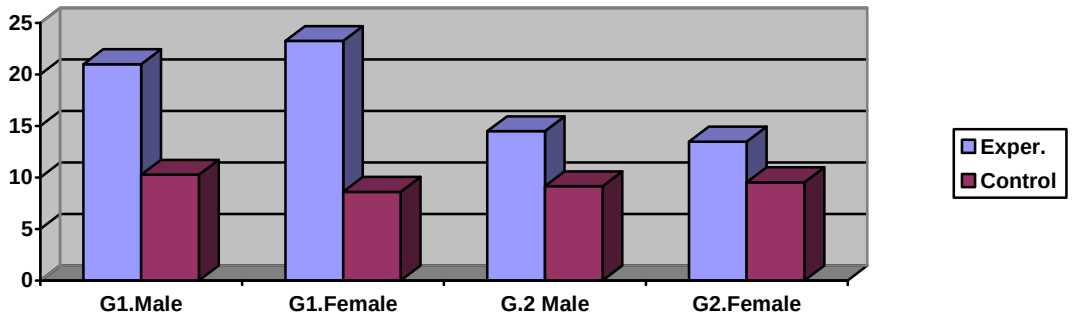
This figure shows that the mean gains of male students in control schools was 9.2 percent and that of female students was 9.5 percent. A mean gain difference of 0.38 percent was not statistically significant (t=.348, df=606, sig=.728). Similarly the mean gain of male students was 14.5 percent in experimental schools and that of the female students was13.5 percent. The mean gain difference of 0.99 percent is again statistically insignificant. This means that IRI contributes to equal performance of students.

The most important finding here, however, is the fact that interactive radio instruction has increased the gains more than traditional instruction within similar sexes. Traditional instruction increased male performance by 9.2 percent whereas Interactive Radio Instruction did it by 14.5 percent. This is an advantage of 5.3 percent. Similarly the mean gain of female students from traditional instruction (9.5 percent) increased to 13.5 percent in Interactive Radio Instruction. This was an advantage of 4 percent. From this perspective IRI closed performance gaps as well as increased academic gains of female and male students.

4.8. Comparisons of Grade 1 and Grade 2 Results by Sex

It is interesting to see that the academic gains of both sexes in traditional instruction in both Grades 1 and 2 were not statistically significant. In experimental schools, females gained more than males in Grade 1, but this difference disappeared in Grade 2. The following graph shows the general trend.

Figure 8 Comparison of Academic Gains in Grades 1 and 2 by Sex



In both grades the common characteristics is that academic gains were higher for experimental schools than for control schools for both sexes. Although IRI has tended to benefit girls at the beginning it has fostered equity of achievement between both sexes thereafter. Table 9 indicates these results more accurately in a summary.

Table 9. Comparison of Grade 1 and Grade 2 Results by Sex

Mean Gains	School Type	Grade 1 Academic Gains		Significance	Grade 2 Academic Gains		Sig.(2 tailed)
		Male	Female		Male	Female	
	Control	10.27	8.60	0.16	9.15	9.53	.293
	Experimental	20.99	23.24	0.032	14.48	13.48	.728

4.9. Students' Academic Gains in Control Schools by Location

Student learning in both urban and rural control schools has improved much when results in the pre-test are compared with that of the post-test. As the table below shows, the mean academic gains of urban control students was 8.30 percent while that of the rural control students was 10.87 percent.

Table 10 Students' Academic Gains in Control Schools by Location

Type of Test	School Location	Number of Participants	Mean Scores	Std. Deviation	Sig. (2 tailed)
Post-test	Urban	369	52.44	15.80	
	Rural	240	47.34	15.40	
Pre-test	Urban	369	44.13	11.98	
	Rural	240	36.46	11.39	
Mean Gains	Urban	369	8.30	12.61	.000
	Rural	369	10.87	14.52	.021

Correlation (r) between pr-etest & pos- test results (urban=.618, sig.= 000;rural= .445, sig.=000). Mean gain difference = 2.319

Although the above finding also shows that the traditional dominance of urban schools in English learning was significantly changing in favor of rural control schools. The consideration of mere achievement results (mean scores), however, indicates that the standard of English learning in general was higher in urban schools both at the beginning and end of Grade 2.

4.10. Students' Academic Gains in Experimental Schools by Location

In schools supported by Interactive Radio Instruction, it is obvious that student learning achievement at the end of the year was significantly better than what existed at the beginning of Grade 2. The mean academic gains for urban experimental schools were 12.30 percent whereas rural experimental demonstrated an average gain of 15.92 percent.

Table 11 Students' Academic Gains in Experimental Schools by Location

Type of Test	School Location	Number of Participants	Mean Scores	Std. Deviation	Sig. (2 tailed)
Post-test	Urban	407	54.58	15.74	
	Rural	360	57.30	15.92	
Pre-test	Urban	407	42.27	12.74	
	Rural	360	41.37	12.98	
Mean Gain	Urban	407	12.30	13.23	.000
	Rural	360	15.92	12.56	.000

Correlation (r) between pretest & post test results (urban=.586, sig.= 000;rural= .639, sig.000). Mean gain difference=3.62

The above findings indicate that IRI has been more effective in rural schools than in urban schools. This is particularly correct if one notes that rural schools scored less than the urban schools at the pre-test.

4.11. Comparison of Student Mean scores by School Location

In urban schools post-test achievement results were better than the pre-test ones. However, the pre-test results show control schools achieved more by 1.80 percent and that the difference was statistically significant. In the post-test, this trend has been reversed and experimental schools scored better than control schools although the difference was statistically insignificant. But, one has to consider that experimental schools started by 1.80 percent less than control schools at the pre-test.

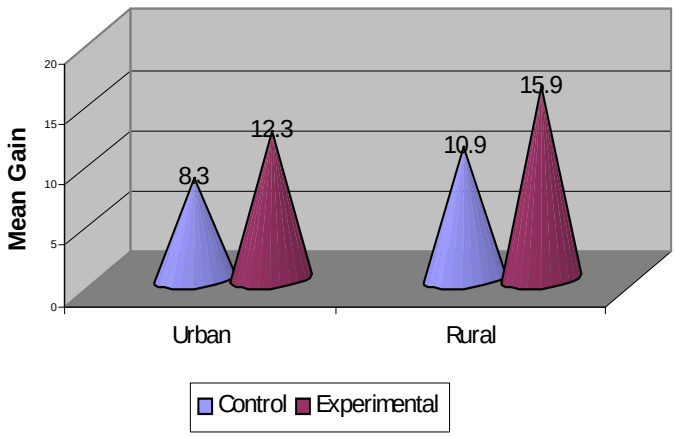
Table 12. Comparison of Students' Means Scores During Tests by School Location

School Location	Status	PRETEST				POSTTEST			
		Mean	N	SD	Sig.	Mean	N	SD	
Urban	Control	44.10	369	11.9831	.037	52.40	369	15.8042	.060
	Experimental	42.30	407	12.7492		54.60	407	15.7424	
	Mean difference	1.80				2.20			
Rural	Control	36.50	240	11.3967	.000	47.30	240	15.4006	.000
	Experimental	41.40	360	12.9811		57.30	360	15.9234	
	Mean difference	4.90				10.00			

In rural schools, both traditional and interactive radio instruction have increased student achievement scores when pre-test scores are compared with post-test results. However, better results of 4.90 percent and 10 percent increase respectively were registered by interactive radio students in both occasions.

A comparison of learning gains, (i.e. the difference of mean scores between post-test and pre-test for the same type of schools) between urban and rural schools shows that experimental school students gained more than students in the control schools. As the figure below shows, the learning gains of urban control schools were 8.30 percent whereas the gains of the rural control schools were 10.87 percent. The mean gain difference of 2.57 percent was statistically significant (t=2.31, df=607, Sig.,=.021.). Similarly, the learning gains of urban experimental schools were 12.30 percent whereas that of the rural experimental schools were 15.92 percent. The mean gain differences of 3.62 percent were statistically significant (t=3.87, df=765, sig,.000).

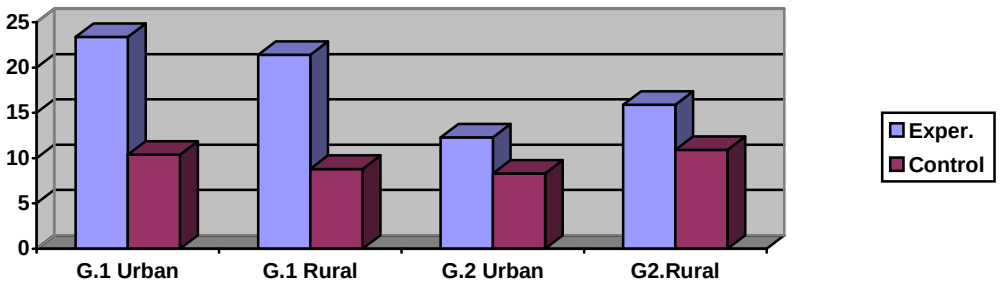
Figure 9 Learning Gains by Location



4.12. Comparison of Grade 1 and 2 Learning Gains by Location

The graph below shows that academic gains were consistently high for experimental schools.

Figure 10 Comparison of Grade 1 and 2 Learning Gains by Location



What is also obvious from the above figure was that learning gains for Grade 2 urban and rural schools were less than the gains for Grade 1. There was a tendency, in Grade 1, for urban students to gain more than rural students whereas this tendency was reversed for Grade 2. It is, however, alarming to see why performance decreased as the grade level increased. The following table is an accurate representation of the above bar graph.

Table 13. Comparison of Mean Gains in Grades 1 and 2 by Location

School Type	Grade 1 Academic Gains		Sig. (2-tailed)	Grade 2 Academic Gains		Sig.(2 tailed)
	Urban	Rural		Urban	Rural	
Control	10.38	8.81	.304	8.30	10.87	.021
Experimental	23.37	21.39	.322	12.30	15.92	.000

The table shows that the decrease in gains was the worst in urban experimental schools followed by rural experimental schools. One explanation may be the familiarity of students with the technology. If the trend continues, it is going to be a challenge for IRI programs in how to make an impact on a sustainable basis.

4.13. Students' Learning Gains in Self-contained Schools

The shift towards self-contained schools is a strong policy direction in Ethiopia. In order to see how interactive radio instruction fares with this approach to classroom instruction, data was collected on whether or not schools follow the self – contained system. Results for those that reported to have adopted the self-contained system is summarized below in the table.

Table 14. Students' Learning Gains in Self-contained Schools

Type of Test	Sch.Type	Number of Participants	Mean Scores	Std. Deviation	Sig. (2 tailed)
Post-test	Control	162	56.68	15.15	
	Experimental	194	56.77	15.53	
Pre-test	Control	162	42.59	12.60	
	Experimental	194	42.29	13.71	
Mean Gain	Control	162	14.08	10.62	.000
	Experimental	194	14.48	14.93	.000

What the above table shows is that the mean gain of control schools was equivalent to the mean gains in experimental schools. It is also interesting to see that Grade 2 control school students in self-contained schools had a similar background with experimental self-contained schools. Although, a generalization is impossible from the given sample, it seems that the self-contained system has encouraging positive effects on students' learning comparable to interactive radio instruction in Grade 2.

4.14. Students' Learning Gains in Linear (Non-self Contained) Schools

The findings below in the non-self-contained schools show that both experimental and control school students scored significantly better in the post test than in the pre-test. That means both traditional and interactive radio instruction have had significant impact on students.

Table 15 Students' Learning Gains in Linear (Non-self Contained) Schools

Type of Test	School Type	Number of Participants	Mean Scores	Std. Deviation	Sig. (2 tailed)
Post-test	Control	447	48.16	15.47	
	Experimental	573	55.74	15.99	
Pre-test	Control	447	40.57	12.19	
	Experimental	573	41.70	12.56	
Mean Gain	Control	447	7.58	13.94	.000
	Experimental	573	13.84	12.34	.000

However, it is also clear that mean gains of students in the experimental schools were 13.84 percent as compared to 7.58% in control schools. Thus, in non-self contained schools, Interactive Radio Instruction had more impact than traditional instruction.

4.15. Comparison of Students' Mean Gain Score by Classroom Structure

From the table below what is clear is that students of control and experimental schools had similar standards at the beginning of the year or pre-test. At the end of the year or the post-test, student learning gains improved but the mean difference between the two groups was similar. In self-contained schools, disparity in students' learning was minimal.

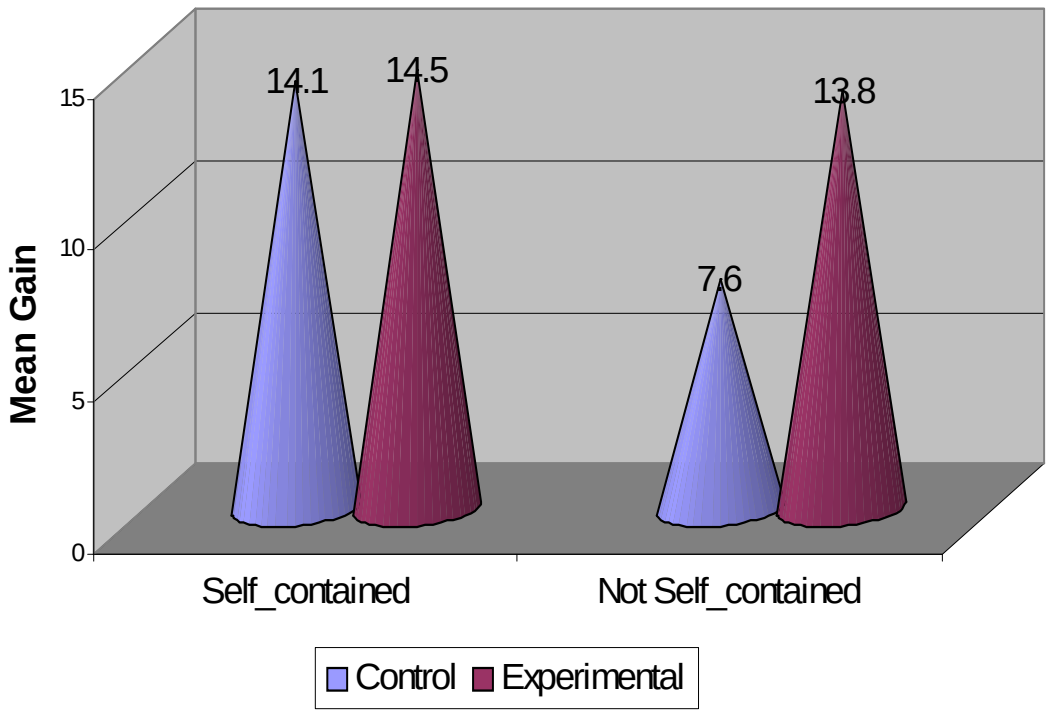
Table 16 Comparisons of Mean Differences at Pre-tests and Post-test

Classroom structure	Status	Pre-test				Posttest			
		Mean	N	SD	Sig.	Mean	N	SD	Sig
Self-contained	Control	42.60	162	12.6084	.831	56.70	162	15.5176	.955
	Experimental	42.30	194	13.7110		56.80	194	16.2544	
	Mean Difference	0.30				0.10			
Non-self contained	Control	40.60	447	12.1997	.150	48.20	447	15.4742	.000
	Experimental	41.70	573	12.5652		55.50	573	15.9901	
	Mean Difference	1.10				7.30			

In non-self contained schools, students had similar standards at the pre-tests. However, experimental school students scored more significantly than control school at the post-test. This means the use of IRI made a difference in these schools.

A comparison of mean academic gains in the same schools along the two testing points (i.e. pre-test and post-test) indicates that there was not a significant difference between the control and the experimental self-contained schools. As the figure below indicates the learning gains of control self-contained was 14.10 percent and that of the experimental schools was 14.50 percent.

Figure 11. Learning gain by Classroom Management

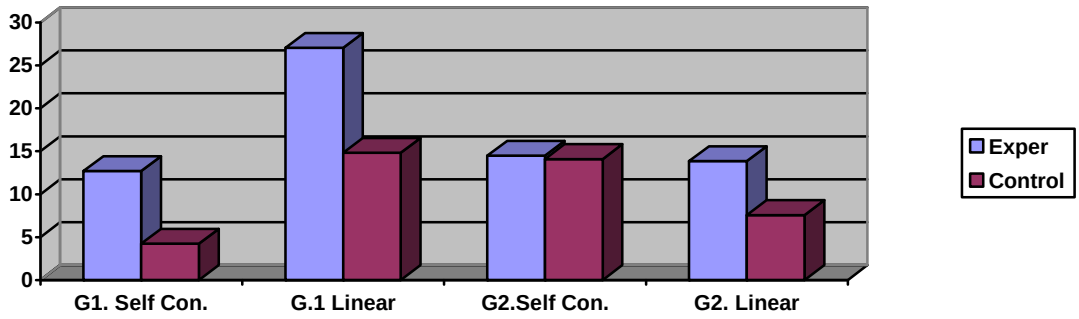


However, in schools having linear approach, the academic mean gains were significantly higher for Experimental schools (13.80 percent) than the control schools (7.60 percent). A mean gain comparison between self-contained and non-self contained schools shows that learning was more effective in the self-contained schools. Interactive radio was almost equally effective in both self-contained and non-self contained schools.

4.16. Comparison of Grade 1 and 2 Learning Gains by Classroom Structure

It is interesting to see that experimental schools are performing well as compared to control schools in both self contained and non-self contained systems. Self contained Grade 1 experimental students gained significantly more than control students, but this difference of 0.48 percent was insignificant in Grade 2. In non-self contained system, the gains of experimental schools were higher than those of control schools, but the general gains were less for Grade 2 than for Grade 1.

Figure 12. Comparison of Grade 1 and 2 Learning Gains by Classroom Structure



An accurate presentation of mean gains in the table below shows that the self-contained approach in traditional schooling made a difference between Grades 1 and 2. This is because the gains grew sharply from 4.23 percent to 14.08 percent (a difference of 9.85%). In non-self contained schools, there were declines in gains from 14.82 percent to 7.58 percent, and this is an issue inviting further research.

Table 17 Comparison of Mean Gains in Grades 1 and 2 by Location

Mean Gains	School Type	Grade 1 Academic Gains		Sig. (2-tailed)	Grade 2 Academic Gains		Sig. (2 tailed)
		Self-contained	Non-self contained		Self-contained	Non-Self Contained	
	Control	4.23	14.82	.000	14.08	7.58	.000
	Experimental	12.69	27.03	.000	14.48	13.84	.555

In experimental schools, still the self contained approach has shown an improved gain from 12.69 percent in Grade 1 to 14.48 in Grade 2. In the non-self contained approach, grains decreased from 27.03 percent to 13.84. Decrease in academic gains in non-self contained approach might be due to the current shift to the self-contained system as a matter of policy guidance through out the nation.

4.17. Pre and Post-test Results by Region and Schools' Status

The table below shows that except for Oromia, Gambela and Addis Ababa, the mean gains of students in experimental schools were better than those in control schools. Given the experiences of several other countries, it was very much unexpected to see such results in these three regions. An investigation of special situations that contributed to the poorer performance of Interactive Radio Programs requires to be carried out.

Table 18 Pre and Post-test Results by Region and School Status

		PRETEST			POST-TEST			Mean
Region	Status	Mean	N	SD	Mean	N	SD	Gain
Tigray	Control	32.0	98	6.4466	41.4	98	9.6152	9.4
	Experimental	33.8	118	8.8382	49.1	118	13.9089	15.3
	M. difference	1.80			7.70			
Amhara	Control	36.4	74	10.4925	53.4	74	15.1303	17.0
	Experimental	35.7	93	9.8033	57.0	93	17.0191	21.3
	M. difference	0.7			4.40			
Oromia	Control	50.7	82	12.4982	62.1	82	13.6494	11.4
	Experimental	44.8	94	14.5461	55.8	94	16.0303	10.0
	M. difference	5.90			6.30			
SNNPR	Control	45.1	116	10.7454	47.8	116	12.4868	2.7
	Experimental	44.1	122	11.1941	55.7	122	12.1973	11.6
	M. difference	1.00			7.90			
Harari	Control	41.1	36	6.9736	51.9	36	11.2214	10.8
	Experimental	47.2	90	12.7669	60.2	90	16.4509	13.0
	M. difference	6.10			8.30			
Dire Dawa	Control	39.2	77	9.2054	44.1	77	16.5991	4.9
	Experimental	45.9	83	11.5897	69.5	83	13.5881	23.6
	M. difference	6.70			25.4			
Gambella	Control	29.4	38	11.9511	41.4	38	20.4275	12.0
	Experimental	34.1	66	7.7474	42.4	66	11.5262	8.3
	M. difference	4.70			1.0			
Addis Ababa	Control	47.9	88	11.9246	59.4	88	14.6981	11.5
	Experimental	48.4	101	14.0179	56.5	101	14.1169	8.1
	M. difference	0.5			2.90			
Total	Control	41.1	609	12.3315	50.4	609	15.8314	9.3
	Experimental	41.9	767	12.8580	55.9	767	15.8755	14.0

Part V

Summary, Conclusions and Recommendations

5.1. Summary

The main purpose of this study was to analyze the academic gains of Grade 2 students exposed to Interactive Radio Instruction programs relative to Grade 2 students who have not been exposed to similar programs in Ethiopia. As secondary objectives, the study has also examined the role of IRI in addressing equity issues as well as compared the academic gains of Grade 2 students with those of Grade 1.

The study was an experimental design with cross-sectional and historical perspectives. Students were randomly assigned to experimental and control groups, and an English comprehension test was conducted at pre-test and post-test in order to measure student achievement gains. Samples were selected from 8 regions, 16 experimental and 16 control schools. The total number of participants in both groups was 1, 376, out of which students in the experimental group constituted 767 and those in control group comprised 609. Findings from the study have shown the following main results.

Main Findings

5.1.1. Students academically benefited from both control and experimental schools. But learning with IRI produced more student gains than traditional instruction by 4.68 percent. The mean gains of control schools were 9.31 percent whereas those of experimental schools were 14 percent.

5.1.2. A comparison of students' total academic gains in Grades 1 and 2 IRI programs indicate that students' academic gains were greater in Grade 1 experimental schools than in Grade 2 experimental schools. In control schools, mean gains remained almost the same.

5.1.3. Students' academic gains by the type of language skills indicated that IRI has shown that the academic gains of experimental schools was superior to those of control schools. However, it has been noted that students' academic gain results in writing remained low.

5.1.4. A comparison of academic gains of students in control and experimental schools by sex indicated that the mean gain difference of male and female students in control schools was only 0.38 percent whereas this was 0.99 percent in experimental schools. This means in both cases gender disparity has been overcome.

5.1.5. The most important finding in the comparison of academic gains by sex was the fact that IRI has increased academic gains more than traditional instruction within the same sex. Traditional instruction increased male performance by 9.2 percent and female performance by 9.5 percent. IRI increased female performance by 13.5 percent and male by 14.5 percent, the difference was statistically insignificant.

5.1.6. A comparison of Grades 1 and 2 results by sex indicated that female students gained more than the males in Grade 1, but this difference disappeared in Grade 2. This shows that IRI fostered equity in student performance as mean gains were statistically insignificant.

5.1.7. A comparison of learning gains by school location indicated that urban and rural experimental schools gained more scores than rural and urban control schools.

5.1.8. A comparison of Grade 1 and 2 students' academic gains by location indicated that learning gains in Grade 2 urban and rural experimental schools were less than the gains of similar school students in Grade 1. The highest decrease was observed in urban experimental schools.

5.1.9. Students' academic gains in relation to regions indicated that except for Oromia, Gambela and Addis Ababa, the mean gains of experimental students were better than those in control schools.

5.2. Conclusions

Students' academic gains were significantly higher in experimental schools than in control schools in Grade 2. This means Interactive Radio Instruction in Grade 2 English has a positive effect on students learning. From the above finding it is possible to conclude that there is a reliable evidence to use the innovation on a wider scale in Grade 2. However, these gains were not as high as those observed in Grade 1. Conditions that led to higher academic gains in Grade 1 IRI may need to be consistently applied in Grade 2 or beyond. Furthermore, one needs to carry out further investigations if at all there are special conditions that led to decreased achievements with increased exposure to IRI in Grade 2.

Interactive Radio Instruction has been effective in increasing academic gains in each of the language skills tested in English instruction. This finding indeed was one of the unknown areas from Grade 1 IRI. However, IRI is not as effective in developing the writing skills of students. Although it is obvious that radio is an audio medium, it is a new approach to overcome that limitation. Thus, IRI programs in Ethiopia have to strengthen their interactive quality to benefit students in practical skills development including writing skills.

A comparison of students' achievement by sex indicated that Interactive Radio Instruction fosters equity. This can be considered very advantageous given that the equity has been achieved with increased academic gains in relation to both sexes. This finding also has a nationwide significance because recent findings in the Second National Learning Assessment indicated that traditional instruction was still characterized by gender inequality in student performance in favor of males.

The fact that IRI urban and rural experimental schools performed better than urban and rural control schools is also an encouraging trend given the disadvantages of rural students in academic performance. However, these gains were less than the gains observed in Grade 1. Such event may be due to the failure to repeat the implementation activities that led to better results in Grade 1. Although it is natural to assume that user schools develop an experience to effectively use IRI on the second year of implementation, the findings indicated that some

degree on interference or support is still required. This means schools may need sustained support for benefiting students from IRI.

In few regions, the academic gains of experimental schools were less than the those of control schools. In fact one of the regions was the biggest in Ethiopia. The other was the capital, Addis Ababa. It is very alarming that IRI was not performing in these regions as expected. Further investigations have to be carried out in these regions to find out how to make IRI more effective and beneficiary for students.

5.3. Recommendations

Based upon the above findings and conclusions the following recommendations are made.

5.3.1. *Interactive Radio Instruction has to be used on a wider scale in Grade 2 s*ince the findings indicate that IRI was effective in improving student performance. In order to maximize the benefits of the programs, however, more conditions need to be arranged, and a study that leads to such arrangements has to be further carried out.

5.3.2. *Interactive Radio Programs require doing more in developing writing skills*: Although IRI has proved to improve different language skills; there is a special demand to emphasize on writing skills. This is because the academic gains from this component were extremely lower than the rest of the language skills tested.

5.3.3. *The Experience of IRI in addressing gender equity need to be shared to traditional schooling*: It is encouraging to see that disparity in students' achievement by gender has been overcome. Since the traditional schooling system in Ethiopia is still tainted with inequity there must be an experience sharing with EMA.

5.3.4. *Schools need sustained support to benefit students from IRI:* IRI has been effective in both urban and rural schools. However, the gains of students have decreased from what has been observed in Grade 1. One way to maximize students' benefits from the innovation is to sustain practices that led to those achievements in grade 1. Thus, it is important to create

enabling conditions in schools to use the new innovation before leaving full responsibility to them.

5.3.5. *Further research on utilization is recommended*: In some regions, students in experimental schools have gained less than students in control schools. Given the worldwide trend, it is very difficult to imagine such results other than for poor utilization. Therefore, it is important to make investigation on utilization of IRI programs and make improvements.

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Appendix I

Country/Start Year	Subject	Status of IRI Program Today
Nicaragua (1974-)	Math, grds 1-3	The first pilot project demonstrated high learning gains and cost effectiveness, but was abandoned due to the revolution. In the first year, math scores on a standardized test increased from 39% to 65% after a year's broadcasting. 465 radio lessons were produced.
Kenya (1980-)	English	The original English as a Second Language showed learning gains, but was not institutionalized for political reasons. In the first year, language arts students scored 18% higher on a standardized test than those in conventional classes.
Thailand (1980-)	Math, grds 1-2	The Radio mathematics was the first adaptation of the original Nicaragua math series and was used to provide better opportunities to rural students. The series is still broadcast in some areas and is being used on cassette in Hilltribe cluster schools in the northeast. Supervisors carry cassettes from school to school on their motorbikes.
Dom. Rep. (1981-)	Integrated programming	The RADECO programs were developed to reach children in areas where there were no schools. Four levels of primary education were developed through a combination of radio lessons and supplementary print materials, and evaluations showed that students learned almost as well or better than children in full-day conventional schools did. Ten years after its inception, the Government still broadcasts the series. A first and second grade math series is also broadcast in formal schools.
Papua New Guinea (1986-)	Science, grds 4-6	The Radio Science programs were the first to be created for upper primary and to use an inquiry approach. Because of its higher demands on teachers, it requires a more intense teacher training component. It has been broadcast for ten years and under new privatization struggles, the National Dept. of Education and National Broadcasting Commission are negotiating how to continue to pay for airtime.
Honduras (1987-)	Math, grds 1-3	A new series of math programs called *La Familia de los Numeros* was produced to make the original math model more relevant. The series was based on mental math and enhanced the teacher's role. A total of 465 lessons were produced. While it was not successfully institutionalized, the IRI methodology was changed to meet newer needs in adult education.
Bolivia (1987-)	Math, grds 1-5	The Bolivia math programs were a more in-depth adaptation of the Nicaraguan series. The first three years were adapted and two subsequent years were created. IRI Math has been broadcast for 10 years and has been a part of the national curriculum. In 1997, the Government looked for ways to make IRI programming consistent with Educational Reform.
Lesotho (1987-)	English, grds 1-3	English programs are still used nationally. The Ministry of Education has levied a tax to pay for the guidebook which accompanies the IRI programs, and the programs are therefore able to be broadcast in every age-appropriate classroom.
Costa Rica, Guatemala, El Salvador, Dom. Rep. (1988-1992)	Math, grds 1-3	Adaptations of the Honduras math were made for neighboring countries. Institutionalization differed per country. The Costa Rica programs are no longer used. The El Salvador series, *El Maravilloso Mundo de los Numeros* is used nationally as part of the basic education curriculum and additional basic education components are being added.
Costa Rica (1991-)	Environ. Ed., grds 4-5	Two pilot series were developed which used adventure stories and a drama format to engage children in environmental activities. The pilot was not institutionalized, but the new style of IRI continues to be replicated in other areas.

Bolivia (1992-)	Health, grds 3-4	Radio Health adapted the IRI methodology to teach health in school through child-to-child strategies. IRI Health has been broadcast nationally for four years.
Honduras (1992-)	Adult basic education	Three levels of adult basic education have been produced and three additional levels are being created and broadcast through an innovative decentralized strategy at the municipal level. The use of IRI is heavy in the beginning levels and then tapers off in the advanced levels.
South Africa (1992-)	ESL, grds 1-2	Two levels of English in Action have been created in South Africa and a third is being developed. The original English model was recast to serve as a teacher training instrument, and to be more open in its approach. The programs are broadcast nationally.
Indonesia (1992-)	Teacher training	A unit was developed within the Government and programs continue to be developed and broadcast.
Portuguese-speaking African countries (1992-)	Math, grds 3-4, Portuguese	Originally developed in Cape Verde for eventual use in Angola, Cape Verde, Mozambique and Sao Tome e Principe, IRI math is now fully financed by the Dutch government through an agreement with UNESCO. 163 grade three math programs have been produced. Grade four math and Portuguese language programs are planned.
Bolivia (1994-)	Early childhood develop.	A new model of IRI was developed to teach ECD practices to adult caregivers and to engage children in developmentally-appropriate activities and play. IRI for ECD is both broadcast and used on cassette in three languages and uses a decentralized implementation approach that has been adapted for the Reform. Programs continue to be developed.
Bangladesh (1995-)	English	The Bangladesh Rural Advancement Committee (BRAC) has decided to introduce IRI English in non-formal schools. Ninety lessons have been developed and an adaptation of the Honduras Mental Math programs are being discussed.
Nepal (1996-)	ECD	UNICEF and Radio Nepal are adapting the model created in Bolivia for three regions of Nepal, with increased emphasis on nutrition, health and gender. The pilot was scheduled to go to scale mid-1997.
Pakistan	English	IRI English for grades 3-5 has been adapted for use in the northwest frontier province. The program is expanding from 40,000 students in 800 schools to using it in the whole province. Preliminary activities are taking place to expand the program to other provinces.
Haiti (1996-)	Reading, civics, math	Programs are being written and produced in Creole to increase the quality of education in primary school. The project is still in pilot stage.
Ecuador (1996-)	Conflict resolution/critical thinking skills	A pilot program is being developed for ECD, kindergarten and first grade to help adults learn how to facilitate the development of critical thinking skills and conflict resolution in young children. A decentralized approach to development and implementation is being used to be consistent with decentralized education systems.
Dom. Rep./Costa Rica (1997-)	English	A two-country ESL pilot is currently being developed with funds from the World Bank. The series has developed a set of learning objectives for teachers on teacher practice as well as learning objectives for students learning English as a Second Language.